

# Antony van Leeuwenhoek\*

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## ABSTRACT

This is an essay about the Dutch linen-draper of the seventeenth century who made more than 500 microscopes and used them to observe the tail of an eel, the sting of a bee, the nose of a louse, the brain of a fly, the spinning apparatus of a spider, the bacteria from his own mouth, etc., and who wrote enthusiastic letters to the Royal Society of London carefully describing what he saw.

**T**HIS little essay about Antony van Leeuwenhoek is dedicated to the man who has a lively curiosity and a child's sense of wonder. It is dedicated to those who are interested in their universe, who are keen and honest observers of it, and who thrill at each new discovery. They are Leeuwenhoek's cousins. Many of them are found in formal laboratories. Others make their investigations wherever they may be. Few share Leeuwenhoek's genius. Many share his spirit. May their tribe increase.

Antony van Leeuwenhoek—whose name is spelled in numerous ways—is one of the most distinguished scientists the world has ever known. This famous Dutchman was not considered a learned man. He was a linen-draper by trade and never learned Latin, yet his observations were eagerly received by the eminent scientists and scholars of his day, his letters have been translated into both Latin and English, and he is known as the discoverer of the protozoa and the bacteria.

Leeuwenhoek was born in Delft on October 24, 1632, and he died there on August 26, 1723. In 1632 Jan Vermeer, the famous painter, was also born in Delft, and, elsewhere in Europe, John Locke, Baruch de Spinoza, and Christopher Wren made their appearances on the human scene.

The world was just beginning to come alive to its own wonders, and people were beginning to realize that if one would see a miracle he need only look around him. People were beginning to question Authority and to value Observation. In England a few people who were concerned about learning from their own observations and measurements were soon to start a society called the Invisible College, which later became the Royal Society of London. It was to the learned members of this society that over a fifty year period Leeuwenhoek was to address 375 letters—most of them il-

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lustrated with red chalk drawings and each one filled with enthusiasm and wonder.

Leeuwenhoek's father, a basket-maker, died when Leeuwenhoek was five years old, and his mother three years later married Jacob Jansz. Molijn, a painter, who died eight years later, in 1648. That same year Antony was apprenticed to a linen-draper in Amsterdam. Several years later he returned to his native town. In 1654 he married Barbara de Mey, the daughter of a serge-draper. She died in 1666, leaving him with the only one of their five children to survive childhood, his daughter Maria. In 1671 Leeuwenhoek married his second wife, Cornelia Swalmius, who shared his life until her death in 1694.

Leeuwenhoek had several civil duties. In 1660 he was appointed Chamberlain of the Chamber of the Worshipful Sheriffs of Delft, and in 1669, after passing the required examination, he was admitted to the profession of surveyor. In 1676 he was appointed trustee of the insolvent estate of Jan Vermeer, and in 1679 he was made a wine-gauger to the city of Delft. In addition to these positions he held that of General District Supervisor. While all of these jobs combined brought him little money, evidently they left him adequate time for his primary occupation—making microscopes and using them to look at things.

Leeuwenhoek has been erroneously called the inventor of the microscope. Actually there is no certainty as to who invented the microscope. It has been claimed by some that Zacharias Janssen (also a Dutchman) made the first microscope in 1590, but there is evidence that Janssen was not born until 1588. Galileo, working in Italy, seems to have made a microscope about 1610, and in 1630 Francesco Stelluti published in Italy the first drawings made with the aid of a microscope.

Leeuwenhoek did not invent the microscope, but he made about 550 microscopes. His best ones he showed to no one. However, he did have visits from the curious (kings and princes, philosophers, physicians, men of science, statesmen, clergymen, and common men), for whom he set up demonstrations. One of those who used a Leeuwenhoek microscope was Peter the Great, who observed the circulation in the tail of an eel. Another person who looked through the glasses of Leeuwenhoek was Thomas Molyneux, a young Irish doctor who visited Leeuwenhoek in 1685 on behalf of the Royal Society. Molyneux is quoted by Clifford Dobell as having written about Leeuwenhoek:

...being ignorant of all other Mens thoughts, he is wholly trusting to his own, which I observe now and then lead him into extravagances, and suggest very odd accounts of things, nay sometimes such as are wholly irreconcilable with all truth (1).

Of Leeuwenhoek's microscopes only ten remain—the best one in Utrecht. The twenty-six bequeathed to the Royal Society have disappeared.

Leeuwenhoek's introduction to the Royal Society came about through his fellow townsman, Reinier de Graaf, who is remembered for his anatomical research on the organs of generation. De Graaf wrote on April 28, 1673, to Henry Oldenburg, the Secretary of the Royal Society:

That it may be the more evident to you that the humanities and science are not yet banished from among us by the clash of arms, I am writing to tell you that a certain most ingenious person here, named *Leewenhoeck*, has devised microscopes which far surpass those which we have hitherto seen, manufactured by Eustachio Divini and others. The enclosed letter from him, wherein he describes certain things which he has observed more accurately than previous authors, will afford you a sample of his work; and if it please you, and you would test the skill of this most diligent man and give him encouragement, then pray send him a letter containing your suggestions, and proposing to him more difficult problems of the same kind (2).

This first Leeuwenhoek letter, which was published in the *Philosophical Transactions of the Royal Society of London*, reads in part:

1. The mould upon skin, flesh, or other things, has been by some represented to be shot out in the form of the stalks of vegetables, so as that some of those stalks appeared with round knobs at the end, some with blossom-like leaves. But I observe that such mould shoots up first with a straight transparent stalk. . . .

2. The sting of a bee I find of a different form than has been described by others. I have observed in it two other stings, that are lodged within the thickness of the first sting, each having its peculiar sheath.

3. Further, I observe, on the head of a bee before, two artus or limbs with teeth, which I call scrapers, conceiving them to be the organs with which the bee scrapes the waxy substance from the plant. Besides . . .

4. As to the eye of the bee, which I have taken out of the head, exposing its innermost part to the microscope; I find, that the bee receives her light just with the same shadow as we see the honey-combs. . . .

5. In a louse I observe indeed, as others have done, a short tapering nose with a hole in it, out of which that insect, when it will draw food, thrusts its sting, which, to my eye, was at least five and twenty times less than one single hair. But I find the head . . . (3).

The Fellows of the Royal Society instructed Oldenburg to encourage Leeuwenhoek to send further communications. Leeuwenhoek's reply was:

I have oft-times been besought, by divers gentlemen, to set down on paper what I have beheld through my newly invented *Microscopia*; but I have generally declined; first, because I have no style, or pen, wherewith to express my thoughts properly; secondly, because I have not been brought up to languages or arts, but only to business; and in the third place, because I do not gladly suffer contradiction or censure from others. This resolve of mine, however, I have now set aside, at the intreaty of Dr. Reg. de Graaf . . . (4).

Further on in the letter Leeuwenhoek requested:

I beg you, therefore, and those Gentlemen to whose notice these may come, please

to bear in mind that my observations and thoughts are the outcome of my own unaided impulse and curiosity alone . . . (4).

Such curiosity! Leeuwenhoek's ever increasing wonder at the life he observed with his microscopes gave his letters a vitality which will never fade. For example, in his famous eighteenth letter to the Royal Society (October 9, 1676), which covers seventeen and one-half folio pages and which is the first paper ever written on bacteriology, Leeuwenhoek wrote:

The animalcules which I have throughout called "oval animalcules" are not really oval, unless you look upon them on the back or upper part of their body; and as the making of observations is well-nigh a study in itself, I have just now exhibited them to myself very prettily in side-view and have demonstrated not only their little feet, but also their head, and their very short and pointed little tail. At such perfection in this tiny creature I did greatly marvel . . . (5).

In this letter he also wrote:

I must say that for my part no more pleasant sight has ever yet come before my eye than these many thousands of living creatures, seen all alive in a little drop of water, moving among one another, each several creature having its own proper motion . . . (6).

Leeuwenhoek took the whole world of minute things to be his province. He studied bacteria, protozoa, spermatozoa, water, blood corpuscles, muscle fibers, nerve fibers, the structure of the lens of the eye, the structure of bone and teeth and hair, the corn weevil, the grain moth, the flea, the spinning apparatus of a spider, the brain of a fly, duckweed, and oak wood, to name only a few objects of his observation.

Leeuwenhoek's own body frequently supplied him with material for study. In his letter of May 31, 1678, he wrote in great detail about his studies of hairs from his beard, his hand, his nostrils, his eyelid, and his eyebrow. About his own feces he wrote in his letter of November 4, 1681:

This induced me several times, when my excrement was so thin, to examine it; and now and then I noted down what food I had eaten and what drink I had taken, and what I saw. . . . All the afore-said particles lay in a clear, transparent matter, in which clear matter I have sometimes seen animalcules moving very prettily . . . (7).

About the "fur" off his own tongue Leeuwenhoek wrote in June 1708:

At the latter end of the month of April 1708, I was again seized with a high fever, which stayed with me for four days, rising higher each night; and as my tongue was again coated with a thick whitish matter, I oft-times removed some of it, which seemed stuck very tight to the parts of the tongue, with a small penknife or with a silver tongue-scraper: and viewing it many times through the magnifying-glass, I could see nought else but what I have described in my previous discoveries . . . (8).

He studied the bacteria in his own mouth and concluded:

For my part, I judge from my own case, although I clean my mouth in the manner heretofore described, that there are not living in our United Netherlands so many people as I carry living animals in my mouth this very day (9).

However, his own mouth was not as interesting as that of an old man about whom he wrote:

While an old man (who leads a sober life, and never drinks aqua vitae or tobacco and very seldom any wine) was talking to me, my eyes fell on his teeth, which were all coated over; this made me ask him when he had last cleaned his mouth and the reply was, that he had never washed his mouth all his life. So I took spittle from his mouth and examined it, but could not find in it anything but what I had seen in my own or that of the others. I took also the matter that stuck between and against his teeth; on mixing this with clean water in which there were no animalcules, and also with his spittle I observed an incredible number of living animalcules, swimming more nimbly than any I had ever seen up to this time (10).

Leeuwenhoek studied his own seminal fluid. He communicated his discovery of living animals in the semen in a letter dated November 1677, which he had someone translate into Latin before it was sent to the Royal Society. He felt that he might “disgust or scandalize” (11) the learned Fellows of the Royal Society, but he felt bound to publish his discoveries and the methods he had used.

At age eighty-five Leeuwenhoek wrote a letter describing how he made sections of his own skin and saw pores.

And so it was with Leeuwenhoek, a man who sought and found, though it remained for others to know the real importance of his discoveries. Abraham Schierbeek in the final chapter of *Measuring the Invisible World* summarizes Leeuwenhoek’s contributions to science:

It can be seen from the foregoing chapters that Leeuwenhoek undoubtedly deserves the name of “the father of microbiology”; he acquired great merit as a histologist, and he did extremely valuable work as a botanist. He also advanced the study of both pure and applied entomology, and discovered not only spermatozoa, but also parthenogenesis, and the asexual propagation by means of budding; in addition to all this, he also set up a new theory of generation, and discovered numerous organisms (12).

All of this was accomplished by a linen-draper whose hobby was science—a man who knew how to make remarkable microscopes, who must have had remarkable eyesight, and who was pervaded with curiosity and enthusiasm. It is not surprising that, as he lay dying at the age of ninety years, ten months, and two days, Leeuwenhoek summoned his friend Dr. Jan Hoogvliet to his bedside and asked him to translate a couple of letters into Latin and send them to the Royal Society.

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